Inhalation Therapy

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AMERICAN ASSOCIATION OF INHALATION THERAPISTS

"Inhalation Therapy"

"Inhalation Therapy" is the official publication of the American Association of Inhalation Therapists, an organization of therapy technicians working in hospitals and for firms providing emergency therapy service. The Association is sponsored by the American College of Chest Physicians. Contents include news and information pertinent to the profession including medical research, operative techniques, and practical administration.

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Editorial

Training School Standards — Progress Report

THE April 1st **New York State Journal of Medicine** carries on page 1294 a Report of the Special Joint Committee on Inhalation Therapy of the Medical Society of the State of New York and the N.Y. State Society of Anesthesiologists, which is the Committee that last May proposed to the House of Delegates of the A.M.A. a set of standards for the development of training schools for inhalation therapists (See **Inhalation Therapy,** August, 1956).

The report summarizes the situation as it now stands. Dr. John Hinman, Assistant Secretary of the A.M.A.'s Council on Medical Education and Hospitals, has sent out a questionnaire searching into supervision, evaluation of teaching staffs, curricula (length and content), and other aspects of inhalation therapy, and the Council is carefully considering the present state of affairs.

Furthermore, two committees of physicians have been established, one by the American College of Chest Physicians and another by the American Society of Anesthesiologists, to advise the Council.

Dr. Vincent J. Collins, the Chairman of the Special Joint Committee and author of this report, makes complimentary remarks about the AAIT, and says that the A.M.A. Council views the inhalation therapy scene with considerable interest and sympathy. He ends with the encouraging note that progress is being made, and that the Joint Committee intends to continue its study.

The April 13th J.A.M.A. takes a different view of our case. On page 1365 there appears a report from the AMA's Council on Medical Education and Hospitals' Committee on Essentials (the one to whom the proposed standards were finally submitted). This Committee met with the Joint Committee (of the AMA and the AHA) on Paramedical Groups last February, and they apparently concurred in the decision that "training in inhalation therapy might best be integrated with already existing education programs in closely related fields, rather than being an isolated entity."

The Council therefore decided that "further definition and study of inhalation therapy was indicated prior to the establishment of training standards," and felt that training within existing programs was the best arrangement for the present.

One wonders precisely what programs are referred to here. Inhalation therapy in large medical centers is definitely a paramedical specialty involving appreciable considerations in terms of space, equipment, maintenance, record keeping, and at least semi-professional therapists,

usually with the supervision of an anesthesiologist, chest specialist or other physician.

Nursing schools already have their hands full and what training they presently give in inhalation therapy, from our point of view is rudimentary and borders on the superficial. It is our concept that improvement in patient service is our goal as well as the goal of all physicians. In the field of inhalation therapy one of the most needed steps toward this goal is the establishment of standards and training programs for inhalation therapists on a par with other ancillary medical services such as X-ray and physiotherapy.

Patients Are People

IT HAS BEEN established that in certain conditions, e.g., chronic pulmonary emphysema, the use of intermittent positive pressure breathing combined with the inhalation of nebulized bronchodilators and antibiotics is beneficial in a good many instances. The use of positive pressure against exhalation in the treatment of acute pulmonary edema has long been a standard practice in many hospitals. In some burn, shock, and acute cardiac cases, the use of high (approaching 100%) concentrations of oxygen by face mask has been recommended.

We have learned through lectures and reading, the theories and standard procedures for many types of diseases and conditions where inhalation therapy is indicated. However, the clinical application of these procedures we soon find is somewhat different than our studies have shown. For instance, Mr. Joe Green comes into the hospital with an acute coronary occlusion. Indicated treatment is 100% oxygen by mask. But two things contraindicate this therapy. Number One: Mr. Green has had an unfortunate experience in his past, when, as a child, a mask for anesthesia was used on him, and he does not understand the use of the oxygen mask. Mr. Green also has no teeth, many bony prominences of cheeks and nose that make the fitting of the mask to his face both difficult for the therapist and uncomfortable to him.

Rather than insisting on the use of the mask which is both uncomfortable and frightening to Mr. Green, and which might result in a worsening of his condition, it might be more satisfactory to use an air conditioned oxygen tent, combined with additional flows of oxygen, and possibly a nasal catheter as well, to obtain the desired results.

The point is this: Mr. Green is *not* just "Case #940C Coronary, Emergency suite, white, male, age 51." Joe Green is a man who at one time was a boy, who had an experience in a hospital, who had the usual things result in loss of all his teeth, who had a wife, home, children, debts, and worries. In other words, Joe Green is a real person with individuality that makes him as different from Bob Brown as Harry Smith is from John Doakes.

Let's treat our patients with the respect people deserve, and not just another typical case with a number.

Don Gilbert

Respiration Physiology

Lung Volumes
Respired Gases
Gas Exchange

OVER a period of years, the literature published by respiration physiologists in different institutions came to contain a number of confused entities — different names for the same thing — e.g., "Expiratory Reserve Volume" and "Supplemental Air." At a convention in Atlantic City in 1950, a group of the most prominent men in this field met and proposed a standard terminology to be employed thereafter by all researchers and teachers dealing with the subject. It is from this system of symbols and nomenclature that Fig. 1 below has been taken.[1]

This is the second in a series of four articles on basic respiratory physiology. The September one will be concerned with the Control of Respiration.

Transport of Oxygen by the Blood will be treated in the December issue.

And what, one might ask, is the point of making these distinctions between different fractions of the lung's total capacity? Because in discussing the various phases of respiration, it is convenient to refer to certain definite portions of the contained gases which have functional significances not necessarily corresponding exactly to any specific anatomical boundaries.

On examination of Fig. 1, it can be seen that our normal breathing does not exchange an amount of air equal to the total lung capacity, nor even to the so-called vital capacity, but rather it is the quantity known as the tidal volume.

The *Tidal Volume* is the amount of air we inhale and exhale (in and out, like the tide) at any particular time. Clearly, the tidal volume of an individual varies with activity: minimum during sleep, maximum during exercise. At rest, in the normal healthy person, it is roughly 10% of the vital capacity.

After a normal inspiration, it is possible, if one consciously controls respiratory movements, to inhale still more air without first exhaling what has already been taken in. The maximum additional amount which can thus be added is the *Inspiratory Reserve Volume*. Fig. 1 illustrates how this too is variable, and is larger, the smaller the tidal volume. Furthermore, it is possible at the end of an ordinary expiration to exhale more air, and the amount thus removed from the lungs is the *Expiratory Reserve Volume*. Its size is also greater, the smaller the tidal volume.

The *Vital Capacity* is defined as the largest possible expiration that can be voluntarily forced from the

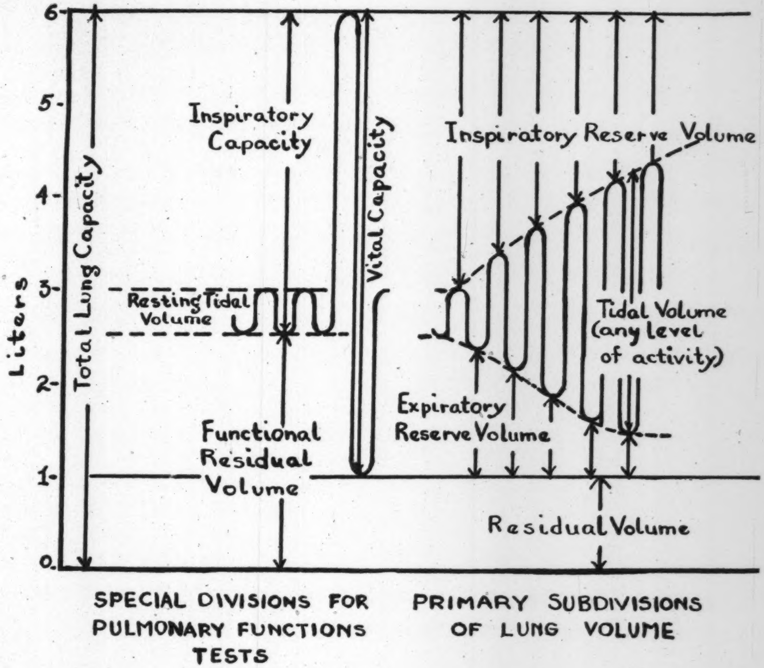


Fig. 1 — From Fed. Proc. 9:602 (1950). Modified by the addition of a scale to provide approximate numerical values for the volumes.

lungs after inhaling the greatest possible volume of air, and this can be seen on the diagram to correspond, logically, to the sum of the tidal volume and the inspiratory and expiratory reserve volumes.

The lungs can never in life be completely deflated, as long as their structural relationships to the pleuras and chest wall remain intact, and the volume of air remaining in them after maximum voluntary exhalation is termed the *Residual Volume*.

The *Inspiratory Capacity* and the *Functional Residual Capacity*, shown at the left of the diagram, are values used by respiration specialists in testing pulmonary function.

Vital Capacity

The vital capacity is so often referred to that a few further remarks about it will be worthwhile. It varies with sex, size and physical development. Development is influenced by occupation: i.e., singers, athletes and wind instrumentalists have larger capacities, by virtue of greater usage. Average adult males have vital

capacity in liters of approximately 2.5 times their surface area expressed in square meters (a meter is 39.4″); that of women is only about 2 times their surface area. This amounts to about 4.5 to 5 liters for men, depending on build, and a little less for women.

The vital capacity is influenced by posture—several hundred cubic centimeters greater when standing than when lying down. This is because (1) gravity opposes the diaphragm when lying down, but aids it when person is standing, and (2) there is more blood in the lungs (less room for air) when lying down than when erect. This difference does not matter to healthy people, but to asthmatics

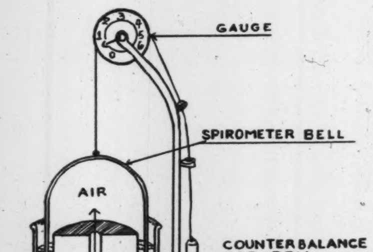


Fig. 2.— Cross-sectional view of the convential spirometer. As patient (with nose closed) breathes into the spirometer, bell rises and counterbalance string moves pointer over calibrated dial to give reading in liters.

and others whose vital capacities are already reduced by disease processes, it may mean the difference between breathing comfortably and being short of breath. When the vital capacity is reduced 40%, the individual becomes dyspneic on only slight exertion.[2]

The extent of decrease in the vital capacity of a patient from the normal value expected for his sex and size is an important diagnostic sign of the patient's clinical condition in several diseases, especially polio, tuberculosis and many of the other respiratory disorders. Hence, the doctor may want to know what his patient's vital capacity is on admission and again at intervals during the course of the illness. It is easily determined by the use of a device known as a spirometer (see Fig. 2). The spirometer is also useful in determining the tidal volume.

Dead Space

It has been pointed out earlier that the gas exchange between blood and air occurs in the alveoli only. The distance between the alveoli and the outside air is just so much tubing, and since no exchange takes place there, it is called the *Dead Space*. It has been found that it is usually about equal to the weight of the person in pounds—i.e., a person weighing 100 lbs. would have about 100 cc of dead space. A value which is therefore rather widely accepted for the average adult is around 150 cc.

The dead space has very great importance in several ways, some of which we are not ready to discuss yet, but one of them can be considered here. Consider the aver-

age tidal volume of, say 450 cc. With each expiration, the last 150 of that 450 is remaining behind in the dead space. It contains a lot of CO_2 and not as much O_2 as fresh air. On the next inspiration, this same stale air in the dead space is swept back down into the alveoli and then diluted with fresh air entering from above. The last 150 cc of fresh air, however, doesn't get down to the alveoli, but fills the dead space. Hence, even though there is a 450 cc tidal, only part of this is fresh air.

The significance of this is that if anything effectively increases the dead space, it will seriously curtail the amount of O_2 getting to the alveoli and CO_2 getting out. Air spaces inside mask face pieces and breathing tubes do exactly this, and the manufacturers of such equipment strive always to keep such space at an absolute minimum.

Another thing about dead space is that one can work the above phenomenon in reverse. That is, if one can do anything to *reduce* the patient's dead space, this will improve his ventilation, by virtue of the fact that a larger fraction of the air getting to the alveoli will be fresh. As with the vital capacity difference between standing and lying, the gain is small in the normal individual, but in a sick person whose ventilation is markedly reduced, the extra CO_2 that can be eliminated by cutting down dead space is of great benefit. One way dead space can be reduced is by doing a tracheotomy. Tracheotomies are seldom done for this purpose alone, but when one has been done to facilitate cleaning out the trachea, reduced dead space is an automatic dividend.

Respired Gases

Until recent years, most citizens never breathed anything but air (except while under anesthesia). Probably during the lifetimes of most of us, we will seldom be called on to deal with any modifications except thinner (as at high altitudes) or thicker (as in diving) air, though some there may be who will on occasion have to breathe various other gas mixtures. For most of us most of the time, the respired gas will be air at atmospheric pressure on the ground (not necessarily at sea level, but not in the mountains or up in a plane).

The percentage composition of air is 20.93% Oxygen, 79% Nitrogen, 0.05% Carbon Dioxide, and just a trace of other gases. Water vapor is also always present, and the amount varies. The percentages above are the chemical composition of perfectly dry air.

Chemical analysis of *expired* air reveals the following: 16% O_2, 79% Nitrogen, 5% CO_2, and trace amounts of other gases. It is *saturated* with water (Relative Humidity, 100%). Three interesting differences are evident: (1) We do not use all the Oxygen in the air we breathe, (2) the expired air contains *100 times as much CO_2* as the inspired air, and (3) no matter how dry the inspired air, the expired air is always saturated. The water which accomplishes this comes from the mucous membrane lining the air passages.

Partial Pressures

The air of our atmosphere has weight and therefore exerts pressure on the earth. This pressure is equivalent to 34″ or 760 mm of

mercury (Hg) at sea level. It is measured by the barometer, and is hence often referred to as barometric pressure.

Dalton's Law of Partial Pressures states that in any given gas mixture, each gas behaves as if it were the only one present, and exerts its partial pressure independently of the other gases.[2] The partial pressure exerted by one of the gases of a mixture is found by multiplying the barometric pressure by the percentage of the gas in the mixture. Hence, at sea level the partial pressure exerted by oxygen and nitrogen would be 760 x 0.21 = 160 mm Hg and 760 x 0.79 = 600 mm Hg respectively. (The partial pressure is denoted by a small letter p when it is written without a space between it and the chemical symbol of the gas referred to; thus "pN_2" is read "partial pressure of nitrogen.")

Water vapor behaves as a gas too, and exerts its partial pressure independently of the others. In the water-saturated air of the alveoli, its partial pressure is 47 mm Hg. Owing to chemical analysis methods, the composition of respired air is expressed as *dry* gas, so if one wishes to compute the partial pressure of a gas in expired air, it is necessary first to subtract the partial pressure of water vapor from the total pressure before determining the partial pressures of the other gases.[2] Suppose one took a sample of expired air and found, with an analyzer, that its O_2 concentration was 16%. The pO_2 would be (760–47) x 0.16 = 114 mm Hg.

Gas Exchange

The primary function of the lung is gas exchange,[3] but this involves several processes. The first is *Ventilation*, i.e., getting air to the alveoli from the outside, and vice versa (it must be continually borne in mind that the latter is just as vital to the process as the former).

Here we must consider both the depth and the rate of respiration—i.e.., not only the size of the tidal volume, but also the *frequency* with which this amount of air is moved in and out. A term commonly used in this connection is *Pulmonary Ventilation*, which is the volume of air moved in and out in a given time (i.e., number of cc's per breath x number of breaths in the time interval). Usually the time unit understood is one minute, and consequently many authors call pulmonary ventilation the *Minute Volume*, or *Minute Volume of Respiration.*

As can be readily ascertained, the pulmonary ventilation is subject to regulation either by altering the breathing rate or by increasing the tidal volume, or both; and its normal range of values extends from only 4 or 5 liters per minute during sleep to 70 or more liters per minute during violent exercise.

Ventilation consists not only of getting a sufficient tidal volume into the lungs by means of the respiratory movements, but also the matter of *distribution* of this air to all the alveoli.

Several factors affect this distribution: (1) Inspired air gets mixed with and diluted by the air of the residual volume and the dead space; (2) the walls of the bronchi, bronchioles and even the alveolar ducts contain smooth muscle, which by its contraction or relaxation influences amounts of gas that get into the alveoli; (3)

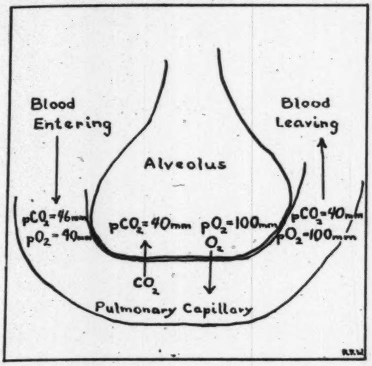


Fig. 3.— For discussion, see text.

certain aspects of the anatomical arrangement of the alveoli with respect to the ductwork that feeds them make airflow easier to some alveoli than to others; and (4) the physics of airflow through small branching tubes is extremely complex.

Pressure Gradients

In the course of metabolic events in the tissues, oxygen is used up and carbon dioxide produced, so that blood coming in to the lungs from the tissues is rather seriously depleted of O_2 and overloaded with CO_2. These gases in the blood exert a tension or partial pressure in much the same fashion they do in air. In the blood entering the pulmonary capillaries which surround the alveoli (see Fig. 3), the pCO_2 is about 46 mm Mg, and pO_2 only about 40 mm Hg. The same values for alveolar air are seen to be 40 and 100, respectively. Here we have a pressure **gradient** or differential for each gas; the gas **diffuses** from the higher to the lower value.

Diffusion is a simple physical process by which Nature seeks to equalize differences in concentration or pressure of a given substance, by the movement of molecules of the substance from a place of greater to one of lesser concentration or pressure. The diffusion continues as long as the difference exists, but the steeper the gradient (i.e., the greater the inequality), the faster the process.

The relatively smaller gradient for CO_2 than for O_2 here is compensated for by the fact that the CO_2 molecule has certain chemical properties enabling it to diffuse through the capillary and alveolar walls more quickly than O_2 can.

Hence, we see that the movement of O_2 across the alveolar wall and into the blood, and that of CO_2 in the opposite direction, is accomplished by the physical force of diffusion of the gases along pressure gradients existing between alveolar air and the blood entering the pulmonary capillaries.

Perfusion

There is one other thing which affects the amount of gas getting into or out of the blood in the pulmonary circulation, and that is the **perfusion** of the alveoli—i.e., the amount of blood passing through the vessels. Fig. 4 illustrates how the amount of blood perfusing a given alveolus varies with activity, just as we have seen that the ventilation does. It is another example of the great flexibility of the human body in meeting different requirements. Obviously, there is no need under conditions of rest (II), where respiratory demands are small, for every branch of the capillary network to be perfused, and therefore many branches are shut down and have

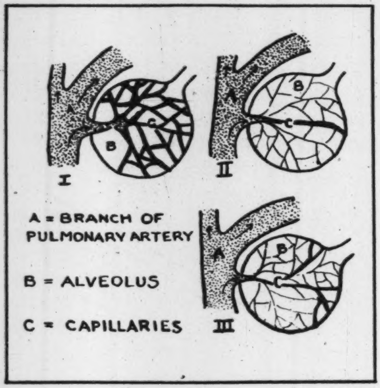


Fig. 4.— Modified from Wearn et al, **Amer. Jour. Physiol.**, 109:236 (1934). The three drawings are all of same alveolus, showing how capillary network may have all, only a few, or practically none of its smaller branches open.

almost no blood circulating through them. Conversely, during exercise (I), respiratory requirements are at a maximum, so all branches are open and more blood is passed by the alveolar wall to take up O_2 and give up its CO_2.

The blood makes its circuit through the pulmonary capillaries in less than one second, and of course, the more that passes through in this time, the more CO_2 lost and O_2 gained.

And so it is evident that by adjusting either the ventilation or the perfusion of the lungs, or both, the body has excellent means of meeting the respiratory demands of a wide range of activities.

Summary

1. We have presented with explanatory remarks some of the standard nomenclature used in scientific and medical papers dealing with respiratory physiology.

2. The chemical composition of respired gases and the important concept of partial pressures have been outlined.

3. The processes of ventilation and perfusion of the lung have been discussed, together with the transfer of respiratory gases by means of diffusion along pressure gradients.

4. The flexibility of the respiratory machine in meeting changing demands has been emphasized.

References:

1. "Standardization of Definitions and Symbols in Respiratory Physiology," *Federation Proceedings*, 9:602 (1950).
2. Leslie F. Nims, "Anatomy & Physics of Respiration," in Fulton's **Textbook of Physiology**, 16th ed., p. 782 et seq. W. B. Saunders Co., Philadelphia, 1949.
3. Comroe et al, **The Lung,** Yearbook Publishers, Chicago, 1955.

Acknowledgement: We are indebted to Mrs. Rosemary Whitacre for the art work in connection with redrawing and modifying figures 1, 3 and 4. Figure 2 is an original drawn for this article.

AAIT To Have Joint Sponsorship Soon

The American Association of Inhalation Therapists will soon be sponsored by the American Society of Anesthesiologists as well as the American College of Chest Physicians. The Society has accepted an invitation issued by the College some months ago to be joint sponsors of AAIT. Action by the Association's Board of Directors is all that is needed to make joint sponsorship official.

When joint sponsorship is official it is anticipated that the Board of Advisors of AAIT will be increased by the addition of three members of the Society of Anesthesiologists.

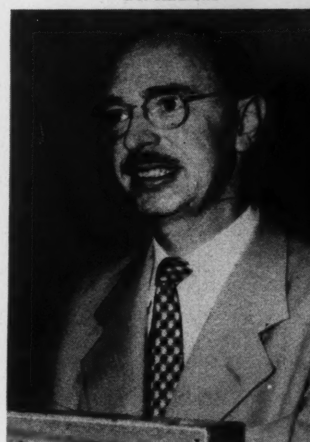
Fruik Brown Dr. Levine Gilbert

Dr. Balagot

Inhalation Therapy at Tri-State Hospital Assembly

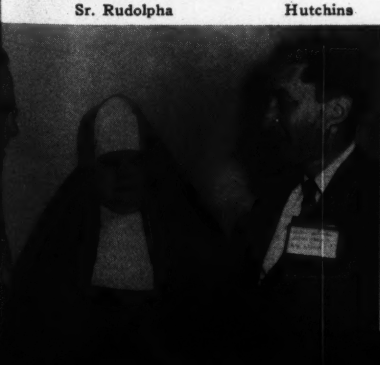
The inhalation therapy section of the Tri-State Hospital Assembly presented two sessions at the Assembly's April-May meeting in Chicago. Dr. E. R. Levine, Larry Fruik, and Frank W. Brown took part in a panel discussion, "Establishing Inhalation Therapy Departments." Don Gilbert presided at the session as official representative of AAIT. Also taking part in the program were Drs. Ruben, Balagot, and Albert Andrews.

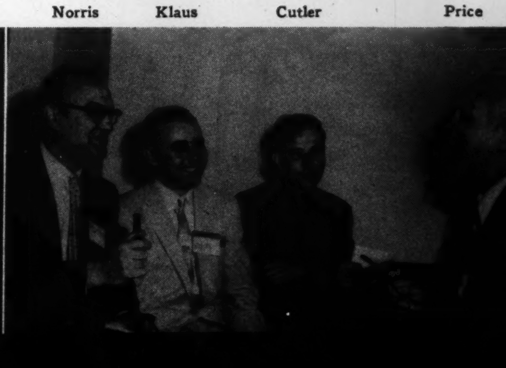
Dr. Andrews



Don Gilbert, Chairman of the Board of AAIT and Sister M. Rudolpha, past chairman, discussed the inhalation therapy session with Ralph C. Hutchins, administrator of Gratiot Hospital in Alma, Michigan. He is a member of the Board of Directors of the Assembly. Waiting for the sessions to get under way, Noble Price made a point with Russell Norris, St. Charles, Ill., Hubert Klaus, Chicago, and Glenn Cutler, Oak Park, Ill.

Sr. Rudolpha Hutchins Norris Klaus Cutler Price





CONTROLLING COSTS

in the Inhalation Therapy Department

ECONOMIC aspects of inhalation therapy were considered in some detail at the "Conference on Inhalation Therapy" held in March in Minneapolis under the auspices of Northwestern Hospital. The national headquaters of the American Association of Inhalation Therapists and therapists themselves frequently receive inquiries bearing directly on the economic aspects of inhalation therapy. In an effort to provide a background which may assist in answering some of these questions three of the papers presented at Minneapolis are condensed here.

"Planning Your Hospital's Future in Inhalation Therapy," by Rudolph Elstad, Assistant Administrator, Northwestern Hospital.

In planning a new hospital, or changes in an existing one, when buying equipment or deciding where and how to place it, get ad-

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Northwestern Conference

MINNEAPOLIS, Minnesota was the scene of a Conference on Inhalation Therapy held March 25-28 in the Radisson Hotel by the Anesthesia Department of Northwestern Hospital.

Mrs. Leah Tharaldson, R.N., Director of Northwestern's School of Anesthesia, conceived and organized the meeting, with the assistance of Mr. Edward J. Riley of the Linde Air Products Company, Bessie Murphy, R.N., of Doctors' Memorial Hospital, and Dr. Russell Bagley of Northwestern.

The four-day program included speakers from the Universities of Minnesota and Michigan, the Mayo Clinic, Chicago and other places, in addition to members of Northwestern's staff.

Topics discussed included all aspects of inhalation therapy from respiratory physiology to the financial aspects of operating an oxygen therapy department and how to plug leaks in the budget. There were talks on the breathing problems encountered by the skin diver; coordination of inhalation therapy with nursing service; IPPB; pediatric inhalation therapy and resuscitation; and many others. Several of the papers appear elsewhere in the journal, and others will be released in later issues.

Over 200 registrants from 16 states were present; this is the largest and most successful independent conference on inhalation therapy we know of to date, and the AAIT salutes Mrs. Tharaldson and her associates for making such a worthy contribution to the advancement of the profession.

vice from all sources, *but particularly from those who are going to use the equipment.*

In setting up the department for Northwestern Hospital, which is a 200-bed hospital, it was decided to have a therapist with three oxygen orderlies to assist her. The therapist is responsible to the Director of Nurses. She consults and recommends equipment when and wherever used, and supervises its operation and its maintenance. The department has an office, a utility room for cleaning and repairing equipment, and a store room to house that not in service. It is located on a medical floor.

Gas is supplied from a liquid oxygen bulk storage sphere outside the building. Pipeline outlets are in all patient rooms, recovery rooms, nursery and the intensive therapy room, which is on the medical floor near the inhalation therapy department.

Equipment (bear in mind the size of this hospital) includes 30 nebulizer-type humidifier-flowmeters, 8 tents, 3 or more analyzers, "an adequate number of disposable and permanent type masks," 8 positive pressure masks, sufficient nasal catheters, 3 Isolettes, 6 Croupettes, 8 incubators, 5 resuscitators, one IPPB machine and 1 Monaghan chest respirator.

"Income & Costs," by Kenneth E. Morgan, Comptroller, Northwestern Hospital.

A well organized inhalation therapy department should produce enough income to cover direct costs and also its share of the indirect costs of the hospital. In determining the charges for service to the patient, the costs of the various types of services should be considered. For instance, depreciation on expensive types of equipment, the estimated volume of expendable or "one time" use of any materials such as plastic masks, cleaning materials, paper towels, etc. The cost of oxygen and the labor in setting up, checking, cleaning and servicing, repairing and storing equipment are other factors to be considered.

"Bulk storage" or piping of oxygen not only eliminates the need for handling cylinders and storing them, but also reduces some of the safety hazards in the use of oxygen. The cost of piped oxygen is quite a bit lower than cylinder, when used in a substantial quantity. Labor required to move cylinder oxygen to the area needing it is also to be remembered when trying to determine the advantages of a piped oxygen system.

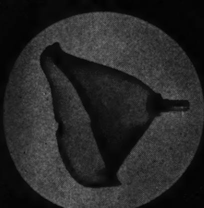
For simpler computation and control, charges should be on an hourly basis rather than a per liter one. Minimum usage can be established for setting up the equipment, as the labor involved would be costly if only an hour or two of oxygen were used.

A minimum charge of $8 for the use of an oxygen tent for up to eight hours has been established at Northwestern Hospital. Additional hours are charged for at the rate of $1 per hour to 24 hours service, and 80¢ per hour thereafter. BLB Mask service is 55¢ an hour, with minimum charge of $1.65. A charge is also made for standby equipment —$3 per day for a tent, and $1.65 for BLB service. Additional charges

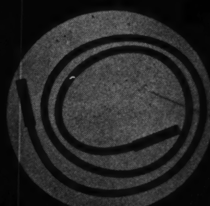
Masks for medium concentration

Masks for high concentration

Plastic Nasal Cannulae



Anatomical Face Cones

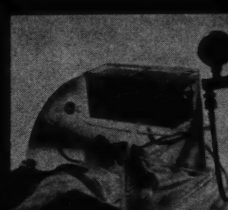


Plastic Oxygen Tubing

Oxygen Tent Canopies

Hudson Safety Humidifiers

Hudson Safety Jars Pint Mason



Hudson Infant Tents

	1954	1955	1956
Number of Hours of Oxygen Service	52,209	49,796*	43,361 *
Average Hourly Income	62.5¢	60.7¢	66.2¢**
Direct Expenses (Salaries, Supplies, Gas, Rentals)	28.1¢	26.2¢	29.0¢
Indirect Expenses plus Depreciation on Pipeline and equipment; Supervision	between 15 and 20¢ per hour of service		

* Decrease due largely to use of Croupettes and compressed air in the Nursery.
** Increase due partly to increase in charges pursuant to increase in operating costs.

are made for disposable dispensers. Nursery and pediatrics oxygen charge is 20¢ per hour.

Above is a table of statistics compiled for patients at Northwestern for the past three years.

Inhalation therapy income and costs should be reviewed periodically to see that the charges to the patient are fair and equitable.

"The High Cost of Turnover," by Leah W. Tharaldson, R.N., Director, School of Anesthesia, Northwestern Hospital, Minneapolis.

The best service and the most efficient use of time and equipment is given by an experienced employee who likes his work and is inspired by it. The best and most efficient service is the least expensive.

However, a great many hours of instruction, study and endeavor are interposed between the start of orientation and the emergence of a fully qualified inhalation therapist, and time is money to both the patient and the employer.

There are several kinds of expense to be considered in this problem of turnover, which plagues every branch of industry.

First: The patient or recipient is assured of a swift, smooth, skilled application of special therapy equipment if the attendant is experienced in the use of the equipment required. If the attendant is a novice or is unfamiliar with the procedure, the treatment will be less effective—therefore, more costly.

Second: Special equipment will be available in good repair and ample quantity if the department is staffed by experienced employees. If it is not so staffed, the equipment is very likely to be out of order, out of place or out of stock, simply because the partially instructed employee has not reached the stage where he can make good evaluation of the situation.

Third: The special time and attention required of the orientation officer will be at a minimum if all areas of responsibility in an inhalation therapy department are covered by experienced help. If not so covered, someone will be obliged to take time to instruct the new recruit in the use and care of specialized equipment.

These three facets of cost of turnover are by no means the only areas

to be considered, but time will permit only a "skimming of the surface" in this particular subject.

Unfortunately, no minimum standards of instruction and experience have as yet been laid out as a guide to orientation of an inhalation therapist. It follows then that full orientation to even the more usual procedures and practices will depend both upon the ability, interest and time the orientation officer can give to instruction, and upon the interest, relative importance and intent of permanence the recruit brings to the specialized work.

In most institutions, the individual charged with the responsibility of instruction and orientation will usually have one or several other jobs demanding attention; so that *every additional hour of that individual's time which is required because of rapid turnover is costly to all concerned.*

Then, too, the more easily understood techniques and procedures will be explained first, and the more complicated aspects of the job, dealing with preventive maintenance, records, charges, inventories, etc., will be placed later in the period of orientation. Since understanding of use, maintenance and supply of equipment will require of an individual a certain foundation of experience in the job, a varying length of time will elapse between first orientation and arrival at full efficiency.

Obviously, during the orientation and learning period, the new employee will work with something less than the swift efficient action that comes with experience; therefore, the patient will be paying full price for something less than he might have received. This is worth considering, even though it cannot actually be measured in dollars and cents.

Lastly, the cost to the hospital or therapy service company when preventive maintenance is slighted is definitely measurable in several ways:

> **One:** The **time** spent on major maintenance projects which would not have become **major** if proper and timely preventive maintenance of equipment were in operation is in effect lost or wasted time.
>
> **Two:** The **increased cost** of the greater inventory which becomes **necessary** because more or less equipment is out of repair adds to the total cost of the department.
>
> **Three:** The loss of time and comfort to the patient if the requested equipment is inefficient, or out of repair, or not in stock is a grave consideration, though it is not actually measurable.

Turnover is expensive, and real economy is achieved by top efficiency in a job. **We are faced with the need to make these jobs attractive enough to catch and hold the interest of stable, mature men and women.** To do this, we must not only lay down a definite job description and standard, but we must also give stature and dignity to the job and the worker in this specialty of patient care, just as has been done by and for Medical Technologists, X-Ray Technicians, and other groups.

Association News Briefs

Chapter Officers

Many of the AAIT chapters have had elections within the past few months and the officers that the Editor knows of are listed here:

Greater New York Chapter
President: Joseph Klocek
Vice-President: Rocco Cioffoletti
Secretary—Carl Crandall
Treasurer: Abe Kaiman

Delaware Valley Chapter
President: James Peo, Wilmington Hospital
Vice-President: John Roberts, Presbyterian Hospital
Sec.-Treas.: Sister M. deLellis, Misericordia Hospital

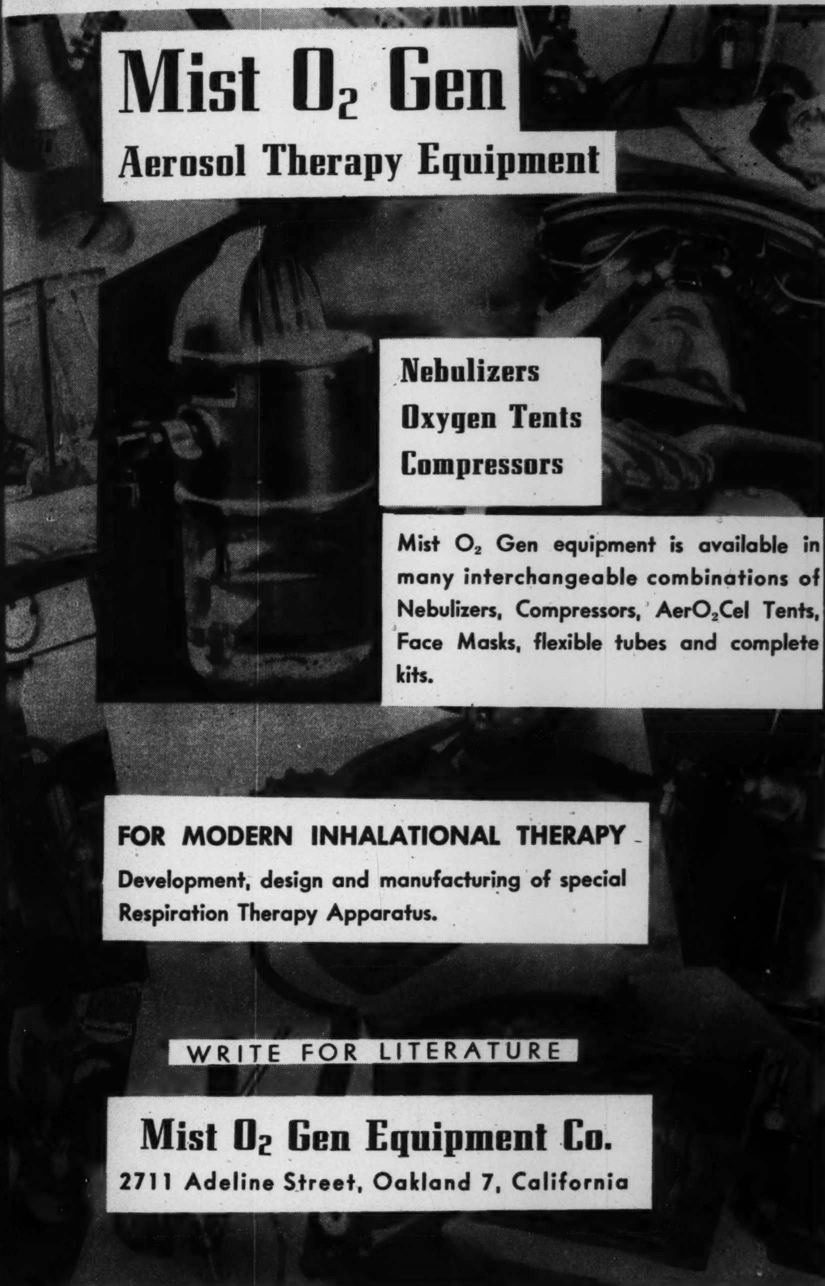
Illinois Chapter
President: Larry Fruik, Edgewater Hospital
Vice-President: Hubert Klaus, St. Ann's Hospital
Secretary: Bob Kruse, Aamed Rents
Treasurer: J. A. Young

Florida Chapter (Florida Society of Inhalation Therapists)

President: Bruce Boyd, Jackson Memorial Hospital
Vice-President: Norman Rush, Professional Oxygen Service
Secretary: Melvin Hall, Victoria Hospital
Treasurer: George Boewig, Doctors Hospital
Sgt. at Arms: Warren Gariepy

One-Day Institute for Illinois Chapter

The Illinois Chapter held a one-day in-stitute in March of this year at th Edgewater Hospital in Chicago. Mor than 60 members and guests attende Many equipment manufacturers a distributors displayed equipment. D E. Levine and Dr. G. Saxton assiste by speaking and demonstrating som of the equipment. Shown below a members of the chapter and chapt advisors who attended the meeting; left is Dr. E. Mörch's recently dev oped respirator which was on displ during a part of the meeting.



Mist O_2 Gen
Aerosol Therapy Equipment
Nebulizers
Oxygen Tents
Compressors
Mist O_2 Gen equipment is available in many interchangeable combinations of Nebulizers, Compressors, AerO_2Cel Tents, Face Masks, flexible tubes and complete kits.
FOR MODERN INHALATIONAL THERAPY
Development, design and manufacturing of special Respiration Therapy Apparatus.
WRITE FOR LITERATURE
Mist O_2 Gen Equipment Co.
2711 Adeline Street, Oakland 7, California

The Editor's Corner

Original Articles

Our largest single problem as a professional journal has been and remains that of getting original articles. If your magazine is to attain the recognition and prestige in the field we all desire for it, then we cannot permit more than a small percentage of our articles to be reprints. That means the majority of them must be original ones written expressly for publication in this journal—either by you, the therapists, or by doctors, nurses, administrators or others interested in this field that we can persuade to help us.

I know you have all heard this before, but I must re-iterate that your editorial staff simply cannot do all this article procurement alone, and that if more of you cannot be actively engaged either in recruiting articles or in being authors yourselves, then we can expect our present standards of quality to fall instead of rising.

Questionnaire

Mention has already been made some time ago of the idea of sending out a questionnaire to a large sampling of U.S. and Canadian hospitals, with a view of getting together representative information from different parts of the country on various aspects of inhalation therapy, such as (for instance) kind and amount of training of therapists, their pay, ways in which inhalation therapy is managed in hospitals not having separate departments, statistical data on usage of different types of therapy and equipment, education programs for nurses and internes, sorts of records kept, patient service charge schedules, etc.

We feel that the AAIT is in a good position to act as clearing house for this sort of information, and that such a store of knowledge as would result from a comparative analysis of the returns from this sort of questionnaire would definitely be of value. Not only would it directly provide material for a number of interesting articles for the journal, it would also make our headquarters better able to answer authoritatively questions on just such matters as suggested above, when they come in to our Executive Director from various interested institutions.

It is our hope to get this questionnaire ready to send out during this year. We are eager to include items that would be useful to the average therapist, and therefore we most earnestly solicit any comments or suggestions you can contribute.

Advertising Credit

People who buy any products because of having seen advertisements for them in the journal, or having seen them exhibited at the convention should let me and/or the company concerned know that this is so. The companies need to be made to realize that we therapists are as important a potential market for their advertising to reach as doctors, nurses, anesthesiologists and administrators are—and for many items, *more* important.

In order to help convince them of this, and thus assure ourselves of their continued advertising, we should make it a point to bring to their attention every instance we know of where their advertising through us (either on these pages or exhibiting at our meetings) has resulted directly in sales — or even in definite enthusiasm in something which may be bought later because of interest growing from this start.

New Equipment

Disposable Oxygen Mask. Pliable polyethylene material makes the Disposable Chieftan oxygen mask conform to the contours of the patient's face as a means of improving comfort. Fit is further controlled by an elastic headband. Air vents safeguard patient from any blockage in the line. Transparent breathing bag is secured to face piece by heat-sealed seams and green vinyl inlet tube is sealed to the bag in the same way. Mask and bag weigh a total of one and one-half ounces. Each mask comes individually packaged in a plastic bag for protection on the shelf. **No. 221**

News briefs on new equipment and technical tips will appear in the journal from time to time. If you know of any new developments in either field, please send them to Robert Kruse, Associate Editor, c/o Inhalation Therapy, 404 Lake Street, Oak Park, Illinois.

Respiratory Bed Helps Iron Lung Patients to Adjust. Tomac Respiratory Bed is designed for patients who are convalescing after a period in an iron lung. The bed is capable of slow, rhythmic movements that are adjustable to the patient's respiratory rate. Adjustments can be made without stopping the motion of the bed. The tilt is adjustable from 30° head-end down position to 40° foot-end down position. Excursions range from 12 to 30 per minute. **No. 222**

MORE DATA . . .

. . . can be obtained by mailing this coupon to "Inhalation Therapy," Room 904, 332 So. Michigan Ave., Chicago 4, Ill.

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Abstracts

"Antifoam Agents in Pulmonary Edema," by Reuben C. Balagot, M.D., Rosauro M. Reyes, M.D., and Max S. Sadove, M.D., in *JAMA* 163:630 Feb. 23, 1957.

Evidently investigators as early as 1952 were trying silicones as antifoam agents to combat pulmonary edema, but only recently has this approach been tried more extensively. The present group induced pulmonary edema artificially in rabbits by intravenous injection of adrenaline, and then treated the condition with aerosols of ethyl alcohol (10 and 20%), octyl alcohol, and a new substance containing a silicone called compound 5507 by the authors. They did not try 95% alcohol, as they found the vapors too irritating to the tracheobronchial tree.

They found the silicone agent more effective than ethyl alcohol, and without the depressant action on the central nervous system produced by alcohol. It was tried with great success on a series of patients who had developed pulmonary edema from natural causes. It was administered with oxygen, via an IP machine, and proved successful.

The conclusions are provocative, an indicate the need for more research o this subject, as it challenges the positio taken by standard texts.

"Pulmonary Function Testing," b George R. Meneely, M.D., F.C.C.P., i February 1957 *Diseases of the Che* (31:125)

This is a 30-page comprehensive trea ment of the subject, which begins wi a thoughtful analysis of objectives o testing, planning a testing program, i strumentation necessary, time and ski required for conducting the tests, and consideration of what such tests can a cannot reveal. This is followed by e tensive examples of a multitude of di ferent specific tests, with directions f their execution and sample case report It is profusely illustrated with diagram and photos of equipment, examples o records made with each kind, with de scriptive and explanatory remarks, an X-ray photos showing various chest con ditions. It gives full lists of pulmonar specialists and of apparatus sources.

"A More Direct Liquefaction of Bro chial Secretion by Aerosol Therapy," b Edwin Rayner Levine, M.D., F.C.C.P in *Diseases of the Chest*, 31:155 (1957

Dr. Levine discusses the problem o tenacious secretions in the tracheobro chial tree, and the use of aerosols o various types to assist in their remova Glycerine in aerosol detergents has lo been regarded as a necessary evil. Th article shows why and how unnecessar this compound is under the condition inside the respiratory tract.

The use of enzymes and bronchodi- lators in aerosols is also treated, an considerable attention is given expecto- ants such as ammonium chloride an potassium iodide, Dr. Levine definitel preferring the latter. A new aerosol solu- tion containing a detergent and potassium iodide was formulated with no glycerin or other chemicals, and tried on a serie of about a hundred patients, with ver beneficial results. This solution has no been made commercially available (fo information, write Editor).